RAW MATERIALS

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STRUCTURE AND TEXTURE OF CLAYS FROM GZHEL'SKOE DEPOSIT

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Microscopic studies of clays from the Gzhel'skoe deposit have identified variations in their structure and texture correlated with the natural tints of those clays. The clay tint characterizes its type, properties, mineral composition, behavior under heating, and other technological parameters.

A change in the type of argillaceous material often becomes the reason for mass-scale defects in the production of majolica. It is known that low-melting polymineral clays, such as clays from the Gzhel'skoe deposit, are heterogeneous in their structure and texture and in their granulometric, chemical, and mineral compositions.

Argillaceous materials used for majolica production represent a mixture of clay varieties, which is related to their vertical extraction.

Depending on their structural and texture specifics and the nature of their fracturing, theses clays disintegrate into fragments of various shapes and sizes in drying (Fig. 1). However, it is hard to classify clays in a moist state since they have no clearly expressed attributes, except for their tint.

Thus, non-schistose clays disintegrate into lumps of angular, lumpy, nut-shaped, or ellipsoidal forms (Fig. 1*a*, *b*, *g*, and *h*), whereas consolidated clays and argillites disintegrate into acute-angled fragments of various sizes and shapes: isometric, irregular, lamellar, and elongated, sometimes with a curvilinear fracture surface (Fig. 1*d* and *e*).

A clay texture is determined by the spatial distribution of argillaceous and other minerals, organic residues of different sizes, and colloid organic material.

Consequently, based on their texture, clays from the Gzhel'skoe deposit can be classified as follows.

Textures determined by the distribution of particles of different sizes in the rock: argillaceous, aleurite, and sandy; they include schistose, oriented, and felted textures (Fig. 1*f*) [1].

Schistose textures can be horizontal-schistose, ribbon-shaped, lenticular-schistose and irregular-schistose, which depends on the distribution of different minerals and different size of particles in the rock.

Oriented (cryptoschistose) textures arise in slow deposition of clay particles in the absence of a coarse-grained material. Argillaceous mineral particles having a lamellar shape arranged parallel to each other are typical of hydromica clays; less frequently they are found in montmorillonite clays or mixed clays made up by the above minerals.

Felted textures are typical of argillaceous rocks with randomly oriented particles, due to the presence of a large amount of nonargillaceous particles disturbing the regular orientation of clay minerals.

Banded and mottled textures are related to the position of interlayers or areas in clay that are differently colored by finely dispersed iron oxides or hydroxides or by colloid organic compounds.

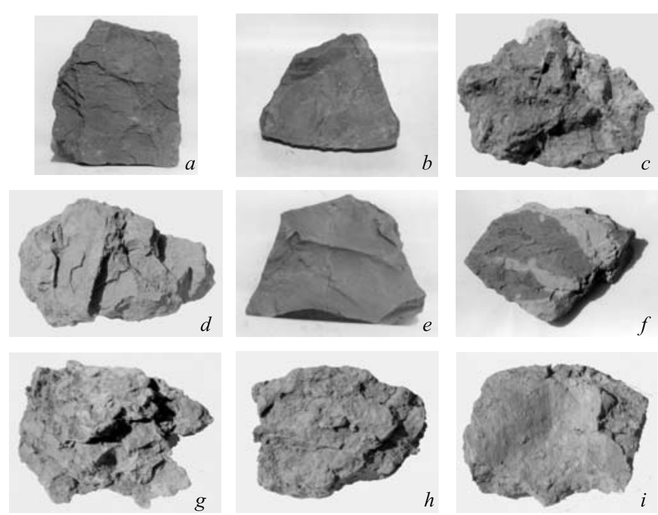

Fig. 1. Texture varieties of clays from Gzhel'skoe deposit: *a*) red-brown; *b*) brown; *c*) variegated; *d*) variegated with inclusions of yellowish-gray-green clay; *e*) red; *f*) schistose; *g*) pistachio; *h*) green; *i*) lilac.

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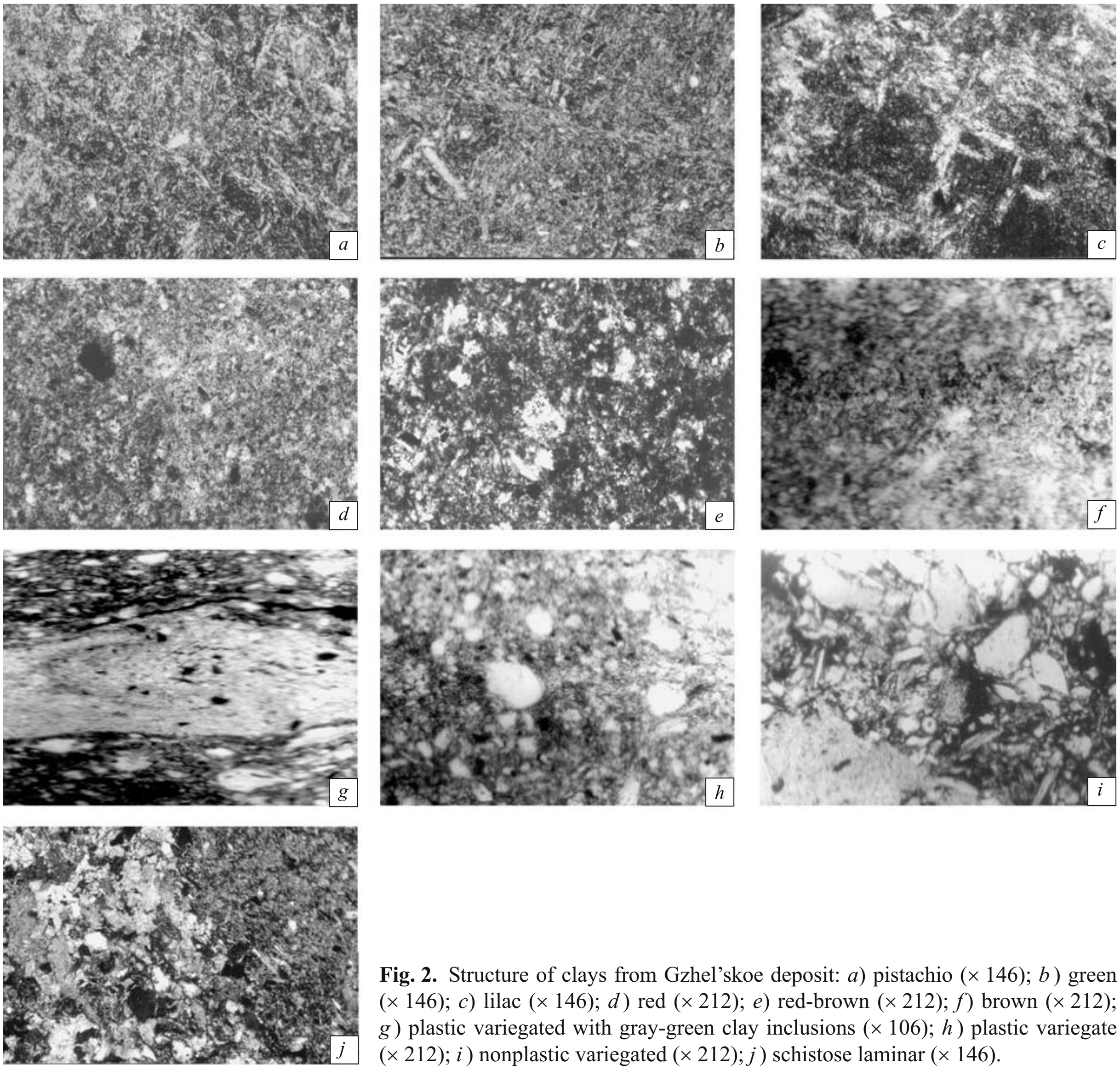

Fig. 2. Structure of clays from Gzhel'skoe deposit: *a*) pistachio (× 146); *b*) green (× 146); *c*) lilac (× 146); *d*) red (× 212); *e*) red-brown (× 212); *f*) brown (× 212); *g*) plastic variegated with gray-green clay inclusions (× 106); *h*) plastic variegate (× 212); *i*) nonplastic variegated (× 212); *j*) schistose laminar (× 146).

Microscopic studied performed on an Omnimet automated complex corroborate that Gzhel'skoe clays of different tints have individual structures (Fig. 2). For instance, pistachio-colored clay has a cross-columnar structure and an insignificant amount of such impurities as quartz (up to 2.3%), pegmatite (up to 2.5%), and carbonates (up to 0.4%). Furthermore, in this clay we identified occasional mica particles and iron compounds represented by opaque black-brown formations of an irregular or isometric shapes and of size 20 – 80 μm.

Green clay contains impurities of quartz (3.5%), pegmatite (4.5%), carbonates (2.6%), mica particles, iron compounds, and chlorites of size from 10 to 50 – 60 μm. Lilac clays has a clearly manifested cross-columnar structure. The impurities in this clay are mainly represented by iron compounds in the form of black-brown formations of size from 10 to 300 – 500 μm in the amount of around 13%. We also identified quartz (1%), pegmatite (0.7%), and carbonates (1.6%). Red clay with the leptopelite structure contains hydromica in the form of packs, quartz (up to 6%), feldspar (up to 2%), carbonates (around 2.9%), as well as mica particles, and iron oxides and hydroxide of an isometric shape. Red-brown clay with the cross-columnar structure contains hydromica as packs, iron hydroxides of an irregular shape up to 450 μm long, quartz (up to 8.8%), feldspar (2.4%), and mica particles of length up to 100 – 150 μm.

The plastic variegated clay with an imperfect orientation of clay particles contains impurities in the form of quartz (up to 9%), feldspar (up to 4%), carbonates (up to 6%), mica particles, and iron compounds of an isometric shape and size up to 60 μm.

The nonplastic variegated clay has a nest-like heterogeneous distribution of carbonate-quartz inclusions in the amount of 11 – 14.9%, as well as feldspar (3.8%) and mica particles of size 180 – 200 μm.

The gray-green interlayer in the schistose clay consists mainly of quartz grains of size up to 100 μm, feldspar 40 – 100 μm, chlorite 40 – 120 μm, and a small quantity of argillaceous material.

Thus, we have identify the presence of detrital impurities (quartz, feldspar carbonates), chlorite, hydromica, iron hydroxide, etc. in all clays of the Gzhel'skoe deposit, which influence the variations in the structure and texture of clays.

Consequently, in the production of ceramics it is important to identify in a timely manner the type of clays comprising a particular clay mixture for the production of majolica. This is necessary in order to predict possible modifications or deviations from the standard technology and control the process of majolica production in order to avoid defective products.

REFERENCES

1. V. P. Avidon, *Preliminary Field Testing of Clays* [in Russian], Nedra, Moscow (1968).